

## CLAIMS

1    1.    An antenna structure comprising:

2  
3        at least one antenna element, the at least one antenna element having at  
4        least one taper; and

5  
6        a symmetrical ground plane coupled with the at least one antenna  
7        element.

1    2.    The antenna structure of Claim 1, wherein the at least one antenna  
2    element comprises a travelling wave antenna supporting a phase velocity  
3    greater than the speed of light.

1    3.    The antenna structure of Claim 1, wherein the taper comprises a linear  
2    profile, a linear constant profile, a broken-linear profile, an exponential profile,  
3    an exponential constant profile, a tangential profile, a step-constant profile, or a  
4    parabolic profile.

1    4.    The antenna structure of Claim 1, wherein the antenna structure supports  
2    a cigar-like directional three-dimensional beam pattern and a butterfly wing-  
3    like directional three- dimensional beam pattern.

1   **5.**     The antenna structure of Claim 1, wherein the at least one antenna  
2   element is positioned at an angle from the symmetrical ground plane.

1   **6.**     The antenna structure of Claim 5, wherein the angle is about 90 degree  
2   with respect to the *x*-, *y*- and *z*- axes.

1   **7.**     The antenna structure of Claim 1, wherein the at least one antenna  
2   element is coupled with the symmetrical ground plane by means of an  
3   unbalanced impedance.

1   **8.**     The antenna structure of Claim 7, wherein the unbalanced impedance  
2   comprises a coaxial cable.

1   **9.**     The antenna structure of Claim 7, wherein a first conductor of the  
2   unbalanced impedance mechanically couples the at least one antenna element  
3   with the symmetrical ground plane.

1   **10.**    The antenna structure of Claim 1, wherein the symmetrical ground plane  
2   is disk shaped.

1 **11.** An antenna structure comprising:

2  
3 an array of at least two antenna elements, each antenna element having  
4 at least one taper;

5  
6 a symmetrical ground plane; and

7  
8 an unbalanced impedance for coupling the array of at least two antenna  
9 elements with the symmetrical ground plane.

1 **12.** The antenna structure of Claim 11, wherein at least one antenna element  
2 of the array comprises a travelling wave antenna supporting a phase velocity  
3 greater than the speed of light.

1 **13.** The antenna structure of Claim 11, wherein the taper of at least one  
2 antenna element of the array comprises a linear profile, a linear constant  
3 profile, a broken-linear profile, an exponential profile, an exponential constant  
4 profile, a tangential profile, a step-constant profile, or a parabolic profile.

1 **14.** The antenna structure of Claim 11, wherein each antenna element of the  
2 array supports a cigar-like directional three-dimensional beam pattern and a  
3 butterfly wing-like directional three- dimensional beam pattern.

1   **15.**   The antenna structure of Claim 11, wherein each antenna element of the  
2   array is positioned at an angle from the symmetrical ground plane.

1   **16.**   The antenna structure of Claim 15, wherein the angle for each antenna  
2   element is about 90 degree with respect to the  $x$ -,  $y$ - and  $z$ - axes.

1   **17.**   The antenna structure of Claim 11, wherein the unbalanced impedance  
2   comprises a coaxial cable.

1   **18.**   The antenna structure of Claim 17, wherein a first conductor of the  
2   unbalanced impedance mechanically couples each antenna element of the array  
3   with the symmetrical ground plane.

1   **19.**   The antenna structure of Claim 11, wherein the symmetrical ground  
2   plane is disk shaped.

1   **20.**   The antenna structure of Claim 11, further comprising a slow wave  
2   antenna to widen the directivity of the antenna structure.

1   **21.**   An apparatus comprising:

2  
3       a transceiver; and

4  
5       an antenna structure for radiating or capturing electromagnetic energy  
6       from or to the transceiver comprising:

7  
8           at least one antenna element having at least one taper, the taper  
9           comprising a linear profile, a linear constant profile, a broken-  
10          linear profile, an exponential profile, an exponential constant  
11          profile, a tangential profile, a step-constant profile, or a parabolic  
12          profile;

13  
14          a symmetrical disk shaped ground plane, the at least one antenna  
15          element being positioned at an angle from the symmetrical disk  
16          shaped ground plane; and

17  
18          an unbalanced impedance for coupling the at least one antenna  
19          element with the symmetrical disk shaped ground plane.

1   **22.**   The apparatus of Claim **21**, wherein the at least one antenna element  
2   supports a cigar-like directional three-dimensional beam pattern and a butterfly  
3   wing-like directional three- dimensional beam pattern.

1   **23.**   The antenna structure of Claim **21**, wherein the angle is about 90 degree  
2   with respect to the *x*-, *y*- and *z*- axes.

1   **24.**   The antenna structure of Claim **21**, wherein the unbalanced impedance  
2   comprises a coaxial cable.

1   **25.**   The antenna structure of Claim **21**, wherein a first conductor of the  
2   unbalanced impedance mechanically couples the at least one antenna element  
3   with the symmetrical ground plane.

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